SCIENCE

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RESEARCH AS A UNIVERSITY FUNCTION[1]

SCIENTIFIC research implies independent and original thinking. It takes for granted that the person has made himself master of recognized facts in the domain where he proposes to extend the boundaries of knowledge, or will proceed to acquire the information. It also takes for granted that every conception is to be tested by material manipulation.

The modern university is derived by integration and adaptation from the learned teaching institutions of early times. As a consequence many medieval features still control the modern institution, often restricting its usefulness. The medieval universities were founded for monks and clerics, who instructed boys and young men in the accepted learning of the times. What they did in the way of adding to the store of knowledge or arranging it for better presentation was done in the quiet of the cloister without thought of reward. In the modern university the investigator may work because he finds pleasure in doing so, and without expectation of encouragement or pecuniary assistance, if he so chooses, but it is the medieval way and not consonant either with the requirements or

[1] The local chapter of the Society of the Sigma Xi in Purdue University, desirous of "encouraging original investigation in science, pure and applied," in accordance with the requirements of its constitution, discussed methods of procedure at a meeting in May, 1918. It concluded that the first thing to do was to make "a survey of the research work in Purdue." Accordingly a committee was appointed, which sent a questionnaire to every member of the instructional force of the university without regard to membership in the society. The report of the committee was presented at a meeting of the chapter January 21, 1919, and the following remarks were made by the president of the chapter as a part of the discussion which followed.

ideals of the present. To extend the boundaries of knowledge as well as of political domains can no longer be done adequately by casual individual effort, as one plays golf, or goes duck hunting, or responds to the love of adventure. There are, however, administrative officers, in fact I am not sure but that the impression is quite general among other persons, who believe that the pleasure of achievement, especially if combined with the approbation of associates, should be considered ample reward for research, even the most prolonged, laborious and costly. The life of the ascetic, comparative poverty, and overwork are preached as the lot to be accepted by the man who delves for hidden lore. It is a musty notion which we as "companions in zealous research" need not countenance.

But the modern world only pays for things that are worth while, not for lore because it is curious or interesting, even when strictly scientific. We hear much at present regarding the value of science. It has been called upon to aid every department of action in the recent war. The very immensity, destructiveness and decision of the conflict rested upon marshaling the achievements of science. It was Germany that led the way, and the rest of the world has opened its eyes to the desirability of cultivating the acquaintance of this much neglected handmaid of national success. Do not forget, however, that Germany's progress in fostering and utilizing science has not been projected over very many years, indeed it has been entirely within the lifetime of the speaker, dating from Liebig's applications of chemistry to agriculture. Leadership is not to be left in German hands unchallenged, if any one may judge by such indications as the establishment in the United States of a National Research Counsel, in England of the Committee of the Privy Council for Scientific and Industrial Research, and of similar organizations in France, Italy and Japan.

But it would seem that the movement to exploit science more fully is directed chiefly to what may be called industrial or applied science, and what is designated pure science must be content to be praised while begging for a crust. As to the distinction between pure and applied science and their relative importance in the welfare of a people I wish to present two illustrations.

I well remember the teaching of my college professor in undergraduate days, showing how organic compounds had such complex molecules, that it would be impossible ever to make them without the aid of the living organism. But eventually indigo was formed synthetically, a most wonderful achievement of pure science, the culmination of more than half a century of effort, and the independent work of hundreds of research chemists. Starting with this result the Badische Company spent seventeen years and five million dollars in industrial research before a pound of indigo could be put on the market.

The indigo of commerce to-day is a possibility realized through the unpaid labor of many men devoted to pure science extending over a long period, followed by the paid labor of fewer workers in industrial science during a much shorter period. It is not necessary to multiply examples to demonstrate what every one knows, that the products of pure science are the material with which applied science works, and that both are needed for advancing the wealth and convenience of the world. It would seem to be the part of wisdom to give equal and abundant encouragement to the workers in both classes of science.

Again I remember the published accounts of the repeated efforts of Professor Langley, of the Smithsonian Institution, to produce a heavier-than-air flying machine. It was difficult to secure funds and even more difficult to awaken intelligent interest. Finally a machine was constructed that flew several hundred feet, and then ignominiously fell into the mud of the Potomac. The daily press found no end of amusement in this episode, and Professor Langley was not able to secure further backing. He was greatly dispirited and mortified, and not long afterward died. Once more, when the Wright brothers of Ohio had so far developed their machine that its capacity for successful flight could no longer be

questioned, the government was unwilling to finance the perfecting of it, and the work had to be completed on the other side of the Atlantic. At the entry of this country into the World War flying machines were greatly needed, and six hundred millions of dollars were largely wasted in experiment before entering upon a course that led to success; a success, however, that placed the first efficient machines in the field just after the fighting was over.

It would seem that the wisdom of preparedness in scientific lines as in others has had a most vivid demonstration in many instances during the course of the Great War. How well it has been learned is yet to be shown in the increased amount of encouragement and support given to both pure and applied science in the days to come. We will see if some of the hundreds of millions of dollars, or possibly billions fortunately conserved by the curtailment of the war will be turned into productive science, or be used for another display of ineptitude.

Most of the members of this society have closer relations with the university, however, than with the government. The purpose of the questionnaire recently sent to the members of the instructional force of Purdue University was to ascertain the attitude of the various individuals toward research, what amount of such work was under way, and what encouragement was being received by them from any source.

The replies show clearly that research is probably favored by all, many are attempting it, and a few succeed. Some persons are not naturally endowed with the qualities that are required by the able investigator, as some do not make good teachers, good administrators, good inventors, etc. A few apparently do not know what sort of effort is required for research. One answers that he does no research because he has not been assigned to it, others say they have no chance to work out their problems. It is undoubtedly true, as I find stated in one of the answers, that "men who are waiting for 'chances' are usually those who have given no objective sign of research ability."

As to the attitude of superiors it appears, except for a few cases, to be favorable, and in some instances most cordial. Part of the feeling that the man above does not support the effort to do original work can probably be ascribed to individual temperament. I find one answering that the attitude of his superior is 'indifferent,' yet the head of this department returns the following statement:

> I feel that not only this university but all institutions of higher learning should encourage research work on the part of its teachers. Nothing should be left undone that could aid in bringing about a healthful activity along this line.

In a department that is not well suited to research one returns the statement that he does none because objection is made by the department, while another says he is engaged in research directed and paid for by the department.

Nevertheless, there seems to be a just and nearly general complaint, except from a few who are in the engineering or agricultural experiment stations, that they are so heavily loaded with routine work that little time or energy is left for research. This brings up the question if it be not a legitimate part of a university man's duty to devote some of his time and strength to extending the boundaries of knowledge, and should not this be recognized and provided for by the university which he serves. What are the functions of a university? The higher institutions of learning are now as they have always been, the source and the disseminators of learning. They have been charged with the two-fold duty of increasing the stock of knowledge and of teaching.

One of the questionnaires brought out this statement: "My ideal of a position is one where most of the time is given to research aided by several interested students, and part of the time taken up with preparing and delivering lectures in courses where one has the benefit of contact with interested students." By adjusting the ratio between teach-

ing and investigation to the subject and to the aptitude of the instructor this would indeed be a generally ideal arrangement, and one by no means beyond the reach of most universities, with due allowance for the "interested students." Every university owes it to itself and to its constituency to maintain a high standard for efficiency, and to attain this a due provision for the encouragement of original thinking and original endeavor is an important factor. The university also owes it to the nation, for a nation that can secure and maintain supremacy in the intellectual field by its contributions to knowledge, its handbooks and treatises, can profoundly influence the course of thought throughout the world, and commands one of the strong elements of national greatness. Mr. W. R. Whitney, of the General Electric Company, said about two years ago:

> The part of research I am most interested in promoting is what we may call the unpaid kind, not because it is cheapest, but because it is most valuable. It is most neglected, most poorly understood, most in need of appreciative support in America. While I am greatly interested in what might be done for science by technical research laboratories in the industries, I am sure that the university must be the important factor in guiding the pioneer work if we are to be a sufficiently advancing nation.

If there be any grain of truth in what was returned upon one of the questionnaires that the university to which we belong, "as an institution [doubtless intending to except the two experiment stations], affords little encouragement and practically no opportunity for research," then this society should exert itself to help in bettering conditions. I am sure the society stands ready to cooperate with the authorities of the university in carrying out whatever program may be found advisable. The committee in its report has made excellent recommendations looking in this direction.

In a statement made last May by the Honorable Elihu Root before the Advisory Committee on Industrial Research of the National Research Council he emphasizes the need of encouragement to research and especially urges a better organization among scientific workers, more cooperation, and a clearer sense of responsibility, closing with the words, "the prizes of industrial and commercial leadership will fall to the nation which organizes its scientific forces most effectively." We need in this institution a more hearty recognition of the importance of research in its reaction upon the individual, of which I have not taken time to speak, in filling a place in the life of the university, and in serving the needs of the nation. If the subject can be estimated at its true value, rather than as an incidental and negligible matter, then time for some work in research for many, if not for all, teachers who may desire it will be forthcoming, even under the most adverse circumstances. One person in answering the question whether investigations are conducted during or outside of school hours says "both, when I can find time which I can not employ better. 'Le temps le mieux employé est celui qu'on perd.'" With a generally accepted high ideal of the value of research that could well be the test for every piece of scientific investigation. It would duly dignify and evaluate the work.

Whether time is to be given to pure or to applied research can best be left to individual choice. One reply reads: "Interested in commercial problems. Do not have much of the scientific spirit of investigation for the pure joy of knowing and of adding to the store of knowledge of the world." But "the pure joy of knowing," the pleasure of accomplishment irrespective of monetary or professional gain, should be the basic incentive for every piece of research, pure or applied. "We are living in the Garden of the Gods, but we are still eating grass," as one writer high in industrial circles visualizes the situation.

I shall venture to close my remarks with the words of Professor Ogden, of Cornell University, speaking recently at the installation of new members into this society on the subject of the purpose of research. I shall, however, take the liberty to reverse the accent placed upon the two forms, pure and applied, as better conveying the general trend of opin-

ion. "May I then express the hope," says Professor Ogden, "that among you," please consider that members of the Purdue Chapter are now intended, "there may be some who will find the subjects for their future experimental work, not only in modern practical applications, in attempted solutions of the many insistent problems of labor, industry and of education, but in abstract research, without thought of reward, carried on in the sole interest of science, that the existence of the university may be more fully justified and the purpose of the Society of Sigma Xi the better realized."

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RAPHAEL BLANCHARD (1858–1919)

ON February 8, 1919, Professor Raphael Blanchard, of the Paris Medical Faculty, the most eminent medical zoologist and medical historian of modern France, died suddenly of heart failure, at the comparatively early age of sixty-one.

Professor Blanchard was born in the little Tourainian village of Ste. Christophe, on February 28, 1857. He was a great-grand-nephew of the famous ballonist Jean Pierre Blanchard, inventor of the parachute, and son of René Blanchard, a dramatic poet, who dying young, left behind him at least one *chef-d'œuvre* of the French stage, the little play of "Pierre Guiffort." Literary and poetic talent was a proper inheritance for the poet's son, who became one of the most distinguished of medical scholars in recent times. A taste for natural science drew young Blanchard to Paris in 1875, where he became attached, a year later, to the histological laboratory of Ch. Robin and Georges Pouchet at the École des Hautes Études. The next two years were spent in Germany, where he studied embryology at Vienna and Leipzig and comparative anatomy at Bonn. Upon his return, he served for a long period as préparateur for the physiologist Paul Bert, at the Sorbonne, and took his medical degree in 1880, with a graduating thesis on anesthesia by nitrous oxide. At the age of twenty-six (1883), he obtained by concours, a professorship in the Paris Medical Faculty. In the meantime, he had published (1883) a little book on the German universities, which was destined to become well known among French educators. Blanchard's scientific career was deeply influenced by his German training, from which he probably acquired his taste for erudition and thoroughness in research. Up to the present war, he was a prominent link between French and German science.

In 1883, in collaboration with Paul Bert, he published a text-book on zoology. In the same year he began his monumental treatise on medical zoology (1885-90), which immediately established itself as the authoritative work on this subject. While the thematic material is mainly parasitology, this work is unquestionably the most comprehensive ever written on the different animals injurious to man. Its geographical and historical details give it a unique place among medical books; the bibliographies attest the wide learning and erudition of the author. With the publication of this work, Blanchard's reputation was established. In 1889, with Milne Edwards, he organized the first international congress of zoology.[1] In 1894, he was admitted to the portals of the Academy of Medicine, an unusual honor for a man of thirty-seven. In 1897, he succeeded Professor Baillon in the chair of medical zoology in the Paris Faculty, and, in 1907, at his request, this chair became specialized as the chair of parasitology. Blanchard made innumerable contributions to parasitology, principally at the Société Zoologique de France, of which he was one of the founders (1876), and for twenty years secretary; and later in the *Archives de Parasitologie*, the most important literary organ of this science, which he founded in 1898 and of which he remained editor until his death. This periodical is everywhere informed by the erudite genius of its editor. To it Blanchard contributed most of his original researches, his many biographies of great parasitologists,

[1] Blanchard was present at the meeting of the Congress in Boston, Mass., August 21, 1907.

living and dead, and many other contributions to the history of medicine. Judged by the illustrations alone, this periodical will always remain one of the most important reference repositories of medical history. Among his other works were monographs on the "Tænia" (1891), the "Coccidia" (1900), a large and important treatise on "Mosquitoes," (1905), a German-French dictionary of anatomical and zoological terms (1908) and a series of monographs on the rôle of insects in infection, which was continued during the recent war in a series of booklets on insects dangerous to soldiers in the trenches, not unlike the series gotten up by Professor A. E. Shipley in England. To anthropology, Blanchard made contributions on "steatopygy in African women" (1883), "the seventh cervical rib of man" (1895), "atavism in man" (1885), "polymastia" (1885) and on "animals injurious to the human race" (1888). Early and late, he did much for medical and zoological nomenclature (1889–1917).[2]

In 1902, Blanchard founded the Institut de médecine coloniale. the first French school of tropical medicine, and in the same year (1902), he also founded the French Society of History of Medicine, a pleiad of talented workers, who met in one of the halls of the medical faculty and whose transactions have been preserved to date. This society has been known to travelers as the most hospitable and attractive of all organizations devoted to this subject, a sort of Mecca for the medical historians.

The last seven years of Blanchard's hard working life were crowned by his great work on medical epigraphy (1909–1915), the intent of which is well described in the subtitle, "Corpus inscriptionum ad medicinam biologiamque spectantium," in other words, no less than a complete collection of all European inscriptions and epitaphs relating to medicine from the time of the Middle Ages down. The plan of this undertaking was originally proposed by Blanchard to the Société française d'histoire de medecine on December 11, 1907, but it was soon discovered that funds were not available and the financing of the proposition was then assumed by Blanchard himself. As it stands, it is one of the most enduring monuments ever made to medico-historical research by the travel method. As far as published, the work comprises some 1,258 inscriptions collected all over Europe and the United States by Blanchard, Wickersheimer and others, each inscription being furnished with an appropriate commentary. Before the appearance of this work, little had been done in medical epigraphy beyond a monograph on medicine in the Roman inscriptions by Jacopo Arata (1902)[3] and a study of the Greek medical inscriptions by J. Oehler (1909).[4] It is now well known that our knowledge of public medicine in antiquity has been largely evolved from the Greek and Roman inscriptions. It is to be hoped that the subject of medical epigraphy will henceforth become an international matter of continuous record and research, to carry out the intention of Blanchard's great work. He was himself one of the noblest advocates of internationalism in science.

Blanchard had been described by those who knew him as a man of the most genial, debonair and attractive type. An engraving in the Surgeon General's Library represents him in the costly vestments of the Paris Faculty, with jabot and dalmatic, his breast covered with many decorations; a towering figure, the countenance expressive of the utmost intellectual refinement. The clean-cut ironic features betoken the type of character which might be either godlike or satanic, but the abiding impression is one of ineffable *bonté de cœur*. In the many group pictures which have appeared, representing Blanchard among his colleagues, he invariably stands out as the *gentilhomme κατ' ἐξοχήν*, as Liszt, Tchaikovski, Saint Saëns did among the musicians. In the decease of this distinguished savant, French science sustains a grave loss.

F. H. Garrison
Army Medical Museum

[2] His last contribution to the subject is in *Bull. Acad. de méd.*, Paris, 1916, LXXVI., 380–389.

[3] Arata, "L'arte medica nelle iscrizioni latini," Genoa, 1902.

[4] Œhler, Janus, Amsterdam, 1909, XIV., 4, 111.

JOHN WALLACE BAIRD

JOHN WALLACE BAIRD, professor of experimental psychology in Clark University, died at Baltimore on February 2, 1919.

Baird was born on May 21, 1869, at Motherwell, western Ontario. From the local school he passed to the high school at St. Marys, and thence to the University of Toronto. His undergraduate course was prolonged, partly by disability due to eye-strain and partly by ventures in teaching; he took his B.A. in 1897.

In his senior year at Toronto Baird came under the influence of Professor A. Kirschmann, who aroused in him the psychological interest that was to dominate the rest of his life. After graduation he spent a further year with Kirschmann, and then—working his passage on a cattle-boat—made his way to Wundt at Leipsic. On his return, he was appointed fellow in psychology at the University of Wisconsin. This appointment was renewed for the following year; but a position fell vacant at Cornell, and Professor Jastrow generously consented to release Baird from his obligations in order that he might accept it. He accordingly came to me as personal assistant in March, 1901, and was made fellow for 1901–02. In 1902 he took his Ph.D. degree. He remained two more years at Cornell, first as assistant in the department of psychology, and then as research assistant on the Carnegie Foundation. From 1904 to 1906 he was instructor in psychology at the Johns Hopkins University, and from 1906 to 1910 assistant professor in the University of Illinois. In 1910 he was called as assistant professor to Clark University, and in 1913 was advanced to the rank of professor.

Baird's productive work is shown by his own writings and by the publications of the students he inspired to have covered a wide range. He spoke with especial authority on the phenomena of visual sensation and perception and on the processes of memory and learning. His interest in vision dates from his Toronto time; a study of abnormal colorsense, published in collaboration with R. J. Richardson in 1898, is, I believe, his first essay in psychological research. He took as the subject of his doctorate thesis the influence of accommodation and convergence on the perception of depth, and his Carnegie Foundation memoir—an admirable bit of work—is an experimental study of the color-sensitivity of the peripheral retina. On the side of memory and learning we have his translation of Meumann's "Psychology of Learning" (1913), and the yearly summaries of experimental papers which he furnished to the *Psychological Bulletin* from 1911 to 1917. Baird's advanced lectures on memory and learning and on the higher intellectual processes would have ripened into books, and indeed would be well worth publishing in the form in which they were last delivered. Unfortunately, he appears never to have written them out in full. He was a born debater, and was openly proud of his ability to speak logically and fluently, on a complex topic, from the scantiest and raggedest of notes. The pride, in a man of extreme modesty, was delightful, and the lectures were always as clear and interesting as he could have wished; but it is doubtful whether enough of their substance can now be recovered to warrant publication. His two latest articles bear witness both to the range of his interest and to the generosity which was an abiding trait of his character. They are entitled "Memory for Absolute Pitch" and "The Rôle of Intent in Mental Functioning," and appear in volumes of essays dedicated to former teachers.

Baird's scientific output, considerable as it was, fails—even if we add his students' work to his own—adequately to reflect his ability and industry. He suffered for many years, and he suffered more than any of us knew, from the malady that was to prove fatal. He seemed able, however, to meet the attacks as they came, and at the time of his marriage in 1914 his friends had reason to hope that his recovery was complete. He threw himself, with zest and humor, into the task of building a house—a house whose hospitality was to rival those other Worcester houses that many psychologists have come to look upon almost as second homes. The house was built, but, alas! was hardly occupied before it was

abandoned. In April, 1918, Baird received an imperative call to Washington, to serve on the committee concerned with plans for the re-education and reestablishment of disabled soldiers. He devoted himself strenuously to this new work, the burden of which undoubtedly hastened his end. He broke down in November, and did not again leave the hospital.

The loss of a man of Baird's caliber would be a heavy blow to any science at any juncture: it is an especially heavy blow to psychology, whose academic representation is meager and which has recently suffered other and serious losses. His untimely death leaves a gap in our professional ranks, of which we shall become more and more sensible as the years go on. But what is now uppermost in our minds is the feeling of personal bereavement. Baird had, in very exceptional degree, the gift of loyal friendship. He made friends everywhere, with all sorts and conditions of men, and the friendships held; his open and cordial nature, his sturdy optimism, and his frank address, were irresistible. Those who were privileged to be his intimates will miss him sorely. It is a satisfaction to remember that during the last year of his life he received the highest honor his colleagues could bestow, the presidency of the American Psychological Association.

E. B. Titchener

SCIENTIFIC EVENTS

REWARDS FOR BRITISH WAR INVENTIONS

The appointment of a royal commission to determine what awards and royalties shall be paid to inventors in respect of the use of their inventions by government departments during the war is announced in *The London Times*. Mr. Justice Sargant is the chairman of the commission, and its other members are: Professor the Hon. R. J. Strutt, F.R.S., Sir James Johnston Dobbie, D.Sc., LL.D., Mr. G. L. Barstow, C.B., Mr. W. Temple Franks, C.B., Mr. A. Clayton Cole, Mr. H. J. Mackinder, M.P., and Mr. Robert Young, M.P. The commission has now issued, and is published in the *London Gazette*.

Certain special conditions are provided as follows:

1. In any case of user or alleged user of any patented invention for the services of the Crown by any government department and of default of agreement as to the terms of user, the commissioners, upon the application of the patentee and agreement to accept their determination, may proceed to settle,, and may settle the terms of user in lieu and place of the treasury: Provided that the commissioners shall not actually award to the patentee any sum or sums of money whether by way of a gross sum or by way of royalty or otherwise which shall together exceed an aggregate sum of £50,000 beyond and in addition to any allowance the commissioners may think fit to make for outlay and expenses in connection with the invention; but the commissioners, if of opinion that the patentee is fairly entitled to a remuneration exceeding the said aggregate sum of £50,000, may make a recommendation to the treasury as to any such excess, with a statement of their reasons for such recommendation.

2. In any case where terms of user of any patented invention (including any terms as to selling for use, licensing, or otherwise dealing with any article made in accordance therewith, or any terms as to assignment of an invention under section 30 of the Patents and Designs Act, 1907), have been agreed, or are in course of agreement, between the patentee and any government department, the commissioners may on the application of the treasury make any recommendation as to the giving or withholding by the treasury of approval of such agreement or proposed agreement, and may assist in adjusting or determining any term or terms of any proposed agreement as to which the parties may not be fully agreed.

3. In any case of user or alleged user for the services of the Crown by any government department of any inventions, designs, drawings or processes which, though not conferring any monopoly against the Crown or any statutory right to payment or compensation, may nevertheless appear from their exceptional utility or otherwise to entitle the inventor, author or owner thereof to some remuneration for such user (including user or by way of selling for

use, licensing or otherwise dealing with any articles made in accordance therewith) the commissioners may, on the request of the treasury, inquire into the circumstances of the case, and may make a recommendation to the treasury as to the remuneration (if any) that is proper to be allowed therefor.

THE REVISION OF PRITZEL'S BOTANICAL DICTIONARY

PRITZEL in the middle of the last century compiled a dictionary of every important published picture or illustration of every known plant, of which he enumerates more than 100,000, giving a reference to the book and page where each illustration may be found; so that any one hearing of a plant he never happened to have seen could look out the name in "Pritzel," and on referring to the book and page given, find a representation of the plant —colored or otherwise.

Pritzel's book is long out of print, and as he finished his work in 1866 it is desirable to bring Pritzel's work up to date. Different scientific bodies (and private individuals) in England and in the United States have from time to time made suggestions for undertaking this work of revision, but as yet none of their suggestions have taken effect, chiefly on account of the very large expenditures and scientific work it involves.

The original Pritzel, which must of course be reprinted, contains about 100,000 entries, and it is estimated that at least 125,000 more entries will have to be incorporated with them. The Royal Horticultural Society has at last definitely undertaken to carry out the work with the assistance of botanists attached to the Royal Botanic Gardens, Kew, the Natural History Museum and the Linnean Society, and in friendly cooperation with the United States government Bureau of Plant Industry.

In 1913 the society began to raise the required amount, the International Horticultural Exhibition held in 1912 starting the fund with a donation of £250 followed by £100 from the Veitch Memorial Trustees and the council of the Royal Horticultural Society voted £250 to which they have since added another £250 to enable the work to be begun. The work has now been actually started, the typists having accommodation found for them at Kew through the assistance of the director, and the whole is under the immediate supervision of the following committee, viz.: Professor I. Bayley, Mr. E. A. Bowles, Mr. F. J. Hanbury, Captain Arthur W. Hill, Dr. B. Daydon Jackson, Mr. Gerald W. E. Loder, Sir Daniel Morris, Sir David Prain, Dr. A. B. Rendle, Dr. O. Stapf, Sir Harry J. Veitch, to which, as has been said, will be added direct assistance from Kew, the Natural History Museum, the Linnean Society and the Bureau of Plant Industry.

GERMAN SCIENCE AFTER THE WAR

Nature quotes from an editorial in *Die Umschau,* for November 30, 1918, by the editor, Professor J. H. Bechhold, in which he indicates the manner in which German science can aid the Fatherland in its hour of defeat and assist it to gain the supremacy in the economic sphere. After pointing out that reconstructed Germany must perforce be simple in order to conform to the new conditions of life imposed upon her by recent events, he asks the question: In what relation shall science, technics and art stand in the new state? Germany, it is explained, must in future seek to live upon her own resources; further, she will have only a small amount of raw material surplus to her own needs, and for this reason it will be incumbent upon her to export the output of her genius; to meet the situation as it should be met, Germany will have to build herself up on efficiency management. She is told that she must attempt to excel all other countries in the quality of her precision instruments and lenses, artificial silks and textiles, dyes and medicines, high-class furniture and works of art, in order to create a demand for these valuable products of her industry in foreign lands. For this reason, Germany will require, says Professor Bechhold, highly trained engineers, chemists, electricians, skilled mechanics and artificers, and, in order that her needs in these directions may be suitably met, she will further require first-class teachers,

first-class training institutions and research laboratories, as well as colleges. These matters are, it is stated, of such overwhelming importance that they must not be permitted to become a class or caste question; there is little danger of this at the present time for already the intellectual men in Germany are combining forces in various directions: this is so in the case of the technical man and the academician, as well as in that of the artificer and the university professor. Finally, an inventors' institute must be founded in order that the inventor may be furnished with advice, the commercial possibilities of his work tested, a selection made of what is best, and a good market found for that which is of real worth.

APPROPRIATIONS FOR THE KANSAS STATE AGRICULTURAL COLLEGE

The Kansas legislature of 1919 appropriated a total of $1,675,500 for the support of the Kansas State Agricultural College for the biennium July 1, 1919, to June 30, 1921. This appropriation is in addition to the amount set apart for extension and demonstration work in accordance with the terms of the Smith-Lever Act. In accordance with this law, the legislature appropriated $63,073.65 for 1919–20 and $75,203.20 for 1920–21, the federal government supplying a like amount for each year of the biennium. The appropriations for the college proper represent an increase of more than $400,000 or approximately 33 per cent., over the appropriation for the present biennium.

One hundred and ninety thousand dollars was appropriated for completing the central part of Engineering Hall. This will more than double the floor space and will house the electrical engineering department which is now located temporarily in Denison Hall. It will also permit of the proper growth and development of the department of farm engineering. More space will be made available for the physics department, and the chemistry department will be able to expand its quarters. The erection of the new portions of the building will also afford proper coal storage facilities, thus economizing tremendously on labor. Work on the building will be begun at once as the sum of $50,000 is available immediately.

The biennial appropriations also include $12,500 for a new water plant for the college, and $10,000 for a new hog plant, buildings and equipment. Ten thousand dollars will be spent in the two years in testing road materials for the state highway commission, the Agricultural College having been made the official testing laboratory for the commission. Forty thousand dollars was appropriated for repairs and improvements each year—an increase of 60 per cent. over the present appropriation. The appropriation for the support of the Agricultural Experiment Station will be increased from $40,000 to $55,000 each year of the biennium.

SCIENTIFIC NOTES AND NEWS

Dr. George Ferdinand Becker, geologist of the U. S. Geological Survey since 1879, died in Washington on April 20, at the age of seventy-two years.

The Federation of American Societies for Experimental Biology is meeting this week at the Johns Hopkins University, Baltimore. The societies included in the federation are: The Physiological Society, the Society of Biological Chemists, the Society for Pharmacology and Experimental Therapeutics and the Society for Experimental Pathology.

The annual meeting of the Association of American Anatomists was held from April 17 to 19 in Pittsburgh under the presidency of Robert R. Bensley, of the University of Chicago.

The executive committee of the American Society of Zoologists has voted to hold the annual Christmas meeting in 1919 in St. Louis in conjunction with the American Association for the Advancement of Science.

Professor Roland Thaxter, professor of cryptogamic botany at Harvard University since 1901, has been appointed professor emeritus.

The Distinguished Service Medal has been awarded to Colonel John J. Carty "for exceptionally meritorious and distinguished services.

He was largely instrumental in securing from the telephone and telegraph companies of the United States the best talent available to meet the urgent requirements of the Signal Corps at the outbreak of the war. He has served with marked distinction as a member of the American Expeditionary Forces and his brilliant professional attainments and sound judgment have rendered his services of exceptional value to the government."

MAJOR GENERAL SIR ROBERT JONES, lecturer in orthopædic surgery, Liverpool University, will act as honorary consultant to the British Ministry of Pensions for orthopædic cases. Sir Robert Jones is inspector of military orthopædics and has been very largely responsible for the surgical and training arrangements carried out in the special military surgical centers.

MISS LUCY MINNEGERO, of Fairfax, Va., chief nurse of the American Red Cross Unit, which was sent to Kief, Russia, in 1915, and later superintendent of nurses at Columbia Hospital, Washington, D. C., and who since 1917, has been in charge of the preparation of the Red Cross nurses for assignment overseas, has been appointed superintendent of the U. S. Public Health Service Nurse Corps.

PROFESSOR C. M. CHILD, president of the American Society of Zoologists, has nominated and the executive committee has unanimously elected the following members of the society as its representatives in the reorganized Division of Biology and Agriculture of the National Research Council: F. R. Lillie, G. H. Parker and M. F. Guyer.

DR. C. LOVATT EVANS, professor of physiology and pharmacology at Leeds, has resigned to undertake research work in the department of pharmacology and biochemistry of the medical research committee.

DR. SOLON SHEDD, head of the department of geology, State College of Washington, has been granted leave of absence for a year to engage in the production of casing head gasoline in the Oklahoma oil fields.

MAJOR GENERAL WILLIAM C. GORGAS, former Surgeon-General of the Army, and a party of sanitary experts arrived in Panama, on April 3, and left April 7, for Guayaquil, Ecuador, to investigate sanitary conditions.

PROFESSOR HERBERT E. GREGORY, of Yale University, leaves on May 8 for Honolulu to assist the trustees of the Bernice Pauahi Bishop Museum in developing plans for scientific work in Hawaii. By arrangement between the museum and Yale University, Professor Gregory is to be absent from New Haven for the remainder of the present academic year and also during the second half of the year 1919–20.

DR. A. HAMILTON RICE, of Boston, will start early in June on his sixth journey of exploration in South America. The United States government will receive from Dr. Rice the results of his geological discoveries upon his return, as has been the case following each of his previous voyages. His biological and ethnological collections have been presented to the Peabody Museum, Harvard University. To navigate the shallow waters of the Upper Amazon, Dr. Rice has had built a 45-foot launch, which is of 14-foot beam and only 20 inches draught. It will be shipped by freight to one of the South American ports and there assembled. The boat contains living quarters and a laboratory.

AT a meeting of the International Association of Poultry Instructors and Investigators held in London, England, March 11–15, 1919, Edward Brown, Fellow of the London Society, was reelected president, and William A. Lippincott, professor of poultry husbandry, Kansas State Agricultural College, as has been noted in SCIENCE, was elected secretary to succeed Dr. Raymond Pearl. Dr. Pearl recently resigned, since, in becoming head of the department of biometry and vital statistics in the school of hygiene and public health, Johns Hopkins University, he is no longer carrying on investigations with poultry. Dr, Pearl was made first fellow of the association in recognition of his untiring service as secretary since the organization of the association in 1912. By invitation of the Netherlands government, a World's Poultry Congress will be held at the

Hague in 1921 under the auspices of the International Association of Poultry Instructors and Investigators.

Lord Rayleigh, who recently accepted the presidentship of the British Society of Psychical Research, gave his presidential address on April 11.

Professor Francis Carter Wood, director of cancer research under the George Crocker Special Research Fund, Columbia University, lectured on April 15, before the Georgia State Medical Society and the students of Emery University, at Atlanta, Ga.

Dr. C. K. Edmunds, president of the Canton Christian College, spoke at the Cosmos Club, Washington, D. C., on April 14, on "Thirty Thousand Miles in China." The lecture was illustrated by lantern slides. Dr. Edmunds is lecturing on scientific aspects of China at different institutions.

Mr. G. S. Baker has given £500 for the foundation at University College, London, of a prize for the encouragement of botanical research to be named after his daughter, the late Dr. Sarah M. Baker, an old student and member of the staff of the college.

George Carlton Worthen, of the Bussey Institution, Harvard University, known for his work in economic botany, died on April 10, aged forty-eight years.

Dr. Henry Wilde, F.R.S., the English physicist died on March 29, at eighty-six years of age.

Sir Edward Charles Stirling, professor of physiology at the University of Adelaide, and director of the South Australian Museum, died on March 20, aged seventy years.

The *Experiment Station Record* notes that the renewed receipt of scientific literature from Germany brings news of the death of Geheimrat Bernhard Tollens, of the University of Göttingen. He died on January 31, 1918, in his seventy-seventh year. A graduate of Göttingen, Dr. Tollens spent several years as assistant in chemistry at Heidelberg and in Paris, going for a year to Portugal, but returned to Göttingen in 1879 as assistant to the famous chemist Wöhler. Three years later he became director of the Agricultural Chemical Laboratory of the Agricultural Institute, occupying that position up to the time of his retirement in 1911. Professor Theodore Dietrich, known for his work on animal nutrition, was director of one of the earliest German experiment stations, established at Haidau in the district of Cassell in 1857, and removed to Marburg in 1880. He died on October 1, 1917, in his eighty-fifth year.

We learn from *Nature* that at a special general meeting of the Geological Society, held in London on March 26, the following resolution of council was carried by 55 votes against 12: "That it is desirable to admit women as fellows of the society." In submitting the motion, Mr. G. W. Lamplugh, president of the society, said: "It will be within the recollection of most of the fellows that the question of the admission of women to candidature for the fellowship of the society has been raised on more than one occasion in the past. It was considered in 1889 and 1901, and, again, more systematically in 1908–09, when a poll of the fellows was taken and three special general meetings were held, with inconclusive results. It is generally recognized that the course of events since these dates has materially changed the situation. Women have been welcomed to our meetings as visitors, and we have had many examples of their qualifications for fellowships in the excellent papers which they have from time to time contributed to the society. The value of these papers has been appreciated by all geologists, and has been repeatedly acknowledged by the council in its awards. Therefore, in the opinion of the council, it is no longer reasonable to maintain a sex-bar against qualified candidates for the fellowship of the society, and I am empowered by the council to submit the above-mentioned resolution for your consideration."

The summer session of the Hopkins Marine Station of Stanford University, situated on Monterey Bay, California, begins on June 17. This session corresponds to the summer quarter of Stanford University, the first half quarter ending on July 23, and the quarter, August

29. There will be six instructors in attendance and ten regular courses are offered, including work in general zoology and physiology, the classification and ecology of marine invertebrates, economic zoology with reference to marine invertebrates and to fishes, invertebrate embryology, marine botany and special work. An announcement will be sent on application to the Hopkins Marine Station, Pacific Grove, California.

PROFESSOR J A. UDDEN, director of the Bureau of Economic Geology and Technology of the University of Texas, reports that much light upon the possible mineral contents of Texas may be obtained by the keeping of records of the holes that are being drilled in search of oil in various parts of the state. It is the theory of many geologists that large potash beds underlie parts of west Texas, and it is thought that this, or other valuable mineral may be discovered in the wild-cat oil wells that are now being drilled in nearly all the counties of west Texas, though oil is not brought to light. Two years ago the United States government sent seven men, experts in their several branches, to Cliffside, twelve miles north of Amarillo, where a permanent camp was established, a first-class derrick put up, and a complete laboratory established to make exhaustive studies of the salts that might be obtained. The results of this investigation have not been published so far, but it is believed enough has been found to warrant further observations. Potash has been found but not in workable quantities. For the present it is not expected that further explorations will be made by the government. The laboratory established at Cliffside, however, will continue to examine cores from any wells that may be sent in. The Bureau of Economic Geology and Technology of the university has also made similar analyses and will continue to make them.

THE Mexico City correspondent of the Journal of the American Medical Association writes that according to recently published statistics, there were 21,915 deaths recorded in the city of Mexico during 1918, and only 7,542 births, which seems to indicate that the population has been reduced by 14,373. But this last figure can not be regarded as accurate because there are always a number of persons who fail to comply with the official regulations for notification in the respective bureaus of the birth of their children. But even making allowance for all this, there is no doubt that the death rate exceeded the birth rate. Influenza was responsible for 1,935 deaths, syphilis for 232, bronchitis for 1,556, bronchopneumonia for 1,456, pneumonia for 2,312, enteritis for 5,496, and various ailments for the other deaths.

Nature states that the Linen Industry Research Association of Belfast is about to appoint a director of research at a salary of not less than £1,000 per year. The selected candidates will be expected to make a survey of the entire field of research in the linen industry, to draft a program of research, and to organize and supervise the carrying out of the scheme.

Two new greenhouses are being completed at the New York Botanical Garden, built through a gift of $100,000 made for the purpose two years ago by Daniel and Murray Guggenheim. These greenhouses form a part of Public Conservatory Range No. 2 on the eastern side of the garden. The larger of the two is designed as a central display greenhouse. Included is a large room where lectures on plant life will be delivered. The smaller of the new greenhouses is designed as an orchid greenhouse to hold the large collection of orchids already accumulated at the garden and others which will be brought from tropical America.

OWING to a reduced appropriation for its work, the American Museum of Natural History finds it necessary greatly to curtail its activities, and announces that one half of the exhibition halls—about 17, it is estimated—have been closed because of lack of funds to pay attendants. The museum is now open from 10 to 4, instead of from 9 to 5, daily. Retrenchment plans include also the elimination of evening lectures in the museum build-

ings and in public schools under the auspices of the museum and a 50 per cent. curtailment of lectures for school children in the museum. All of these measures are designed to cut down expenses for fuel, light, and service, as the minimum appropriation of $240,000 asked for by the museum, figured to cover regular expenses only without provision for further development, has been cut down to $200,00 in the city budget.

By the will of the late Major S. Field Thorn, who died recently in San Francisco, the California Academy of Sciences is to receive "Cragthorn Park," near Santa Cruz, California. The place consists of 242 acres and was Major horn's country home. After the various specific bequests have been paid the academy is to receive the balance of the estate, which it is thought will be considerable. Major Thorn was at one time manager of the Palace Hotel in San Francisco and was for many years interested in the Academy of Sciences.

In connection with the spring meeting of the American Physical Society at the Bureau of Standards, Washington, on April 25 and 26, there will be an exhibit of physical apparatus illustrative of war developments in physics. The exhibit was opened on the afternoon of the 24, all day on the 25 and 26, the evening of the 25 and the afternoon of the 28.

UNIVERSITY AND EDUCATIONAL NEWS

Harvard University and the Smithsonian Institution receive $50,000 each by the will of Mrs. Virginia Purdy Bacon. Columbia University receives $25,000 for scholarships.

By the will of Alexander Cochrane, late of Boston, and head of the Cochrane Chemical Company, Peter Bent Brigham Hospital will receive $10,000 for the establishment of a free bed, and at the termination of a trust fund created for benefit of the members of Mr. Cochrane's family the principal of the trust is to go to Harvard College.

The University of California receives by the will of Mrs. Phoebe Hearst, $60,000, to continue scholarships and a valuable collection of paintings, tapestries and objects of art.

Professor William A. Noyes, head of the department of chemistry of the University of Illinois; Professor Frank Morley, of the Johns Hopkins University, and Professor William T. Sedgwick, of the Massachusetts Institute of Technology, will be included in the faculty of the summer session of the University of California, giving respectively courses in chemistry, mathematics and public health.

At the agricultural college of the University of Idaho, Herbert P. Davis, dairy husbandman, Dairy Division, U. S. Department of Agriculture has been appointed dairyman of the Agricultural Experiment Station, and vice director of the station, and J. E. Nordby, lately first lieutenant in the Motor Section of the Aviation Service, has been appointed associate animal husbandman of the Agricultural Experiment Station, and will have charge of experimental work in animal husbandry.

Captain James Riddick Partington, has been appointed to the newly established university chair of chemistry, tenable at East London College.

Nature states that Professor Ludwig Jost, of Strasburg, succeeds at Heidelberg Professor G. Klebs, who died last October in his sixty-first year, and Dr. W. Ruhland, of Halle, succeeds Professor von Vöchting at Tübingen.

DISCUSSION AND CORRESPONDENCE

BASIS OF THE GEOMETRICAL MEAN AS A B. COLI INDEX

Could I have realized that Professor Cairns would honor by mathematical consideration the "Geometrical Mean" (Science, March 8, 1918) method of obtaining a bacteriological index, I should have hesitated to "wander into paths outside my own domain." However, no elaborate discussion of the mathematical relation between the theory of chance variation and the geometrical mean can be expected to induce the empirical bacteriologist to use it as a *B. coli* index. The simplicity of application and practical utility in daily routine will in the end be its recommendation. Still a brief mention of the grounds on which it seemed to

be based may help to establish it until fuller treatment is possible.

Professor Phelps has thrown light on the problem by distinguishing between the distribution of *B. coli* in space and its distribution in time. The former alone is discussed by McCrady[1] in treating of fermentation tubes made from a single sample. The latter furnished the data for suggesting the "geometrical mean," which was based on a large number of samples taken at different times from single sources, as, for example, given points on a river. Both methods accomplish the same practical purpose by obtaining a weighted mean which eliminates the undue influence of positive high dilutions and the results differ from each other only by a factor which is nearly constant. Whether we wish to base the method à priori on the theory of probability or upon the actual form of the data, becomes an academic problem, but in practise the simpler is naturally to be preferred.

The arbitrary application of the conventional theory of chance to physical data can always be questioned. Bertrand in his "Calcul des Probabilités" calls attention to the fact that if a quantity varies as the law of chance, any observed function of that quantity does not, whereas the choice of the quantity is arbitrary. This distinguishes the mathematical theory of probability from the theory of chance variations of observed quantities. The number and magnitude of the forces acting to change a physical quantity may vary according to the law of chance, whereas the observed change is some function of those forces. Generally those forces combine as a product instead of a sum and so it is believed more fundamental that proportional variations instead of absolute variations follow the conventional law. In physics the variations are very small compared to the arithmetic mean value of the observed quantity and the effect may be commonly negligible because the proportional and absolute variations approach each other. The average is in such cases a very good index of the measurement. In biology, and especially bacteriology, the variations, as in the number of bacteria, are many times as great as the mean value and the geometrical effect becomes so pronounced as to require a logarithmic average or a geometrical mean. Francis Galton[2] discovered the wide practical application of this law and McAllister[3] fully discussed it mathematically.

In the end, therefore, we are thrown back upon the data themselves to determine the most fitting method of reduction and, as the Pearson School of statistics teaches, the sole purpose of such methods is to obtain some representative value of the data. Fortunately, Allen Hazen has given us in probability paper, a simple and sufficiently accurate graphical method of analyzing such rough data. Professor Whipple[4] has summarized and plotted a large mass of bacteriological results and shows that they follow a logarithmic probability curve closely enough. The results obtained in the Investigation of the Potomac River[5] show also that the logarithmic summation curves are strikingly symmetrical about the median line. In the results obtained at the Washington Filtration Plant[6] over a five-year period, the distribution of turbidity readings were found to agree with this form of curve, and the bacteriological results are almost parallel. It is further believed that the practical evolution of the geometrical scale of dilutions indicates that where variations are great the arithmetical scale is but an approximation over short portions of the more natural and fundamental geometrical scale.

[1] *Jour. Infect. Dis.*, 1915, 17, p. 183.

[2] Galton, Francis, "Geometric Mean in Vital and Social Statistics," *Proc. Roy. Soc.*, 29, p. 365, 1879.

[3] McAllister, Donald, "The Law of the Geometric Mean," *ibid.*, p. 367.

[4] Whipple, Geo. C., "The Elements of Chance in Sanitation," *Jour. Franklin Institute*, Philadelphia, CLXXXII., 37, 205, 1916.

[5] Hygienic Laboratory Bulletin No. 104. Table 13, pp. 87–94, and Charts E–H bet. pp. 128–129.

[6] Wells, Wm. Firth, "Some Notes on the Use of Alum in Slow Sand Filteration," *Proc. Am. Water Works Assn.*, 1913.

In conclusion, I suggest a simple rule for obtaining the "score" as an approximation to the "geometrical mean," namely *Revert dilutions*[7] *and apply Phelps Method.*[8] The process of reversion gives the benefit of geometrically reducing the data, and by applying Phelps' Method one obtains an approximate "Geometrical Mean." This is the principle successfully applied in "scoring" oysters.

William Firth Wells
Sanitary Corps U. S. A.

CARDIUM CORBIS A MONŒCIOUS BIVALVE

In the work entitled "Tertiary Fauna of Florida," *Transactions of The Wagner Free Institute of Science of Philadelphia,* Vol. 3, part 5, 1900, p. 1071, William H. Dall makes the following observation with reference to *Cardia:* "Nearly all *Cardia* have two forms, one more equilateral and globose, the other more oblique and elongated, but whether these differences can be correlated with sex is at present unknown."

If attention has been called to the fact that certain species of *Cardia* are monœcious, since Dall made the above statement, the writer of this note is not aware of it.

Variation as mentioned in the above quotation is very noticeable in the common *Cardium corbis* Martyn of the northwest coast. On preparing sections of the visceral region of individuals of this species in recent studies, their hermaphroditic character was clearly shown, masses of ova being interspersed with and sometimes completely surrounded by the spermaries.

I have not had the opportunity of examining other species of *Cardia.* They may or may not be monœcious, but it is evident, from the above observation on *Cardium corbis* Martyn, that variations in this genus must be based upon something other than sexual differences.

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[7] Standard Methods of Water Analyses, Report Committee Am. Public Health Ass'n, 1912.

[8] Phelps, Professor Earle B., *Am. Jour. Pub. Hyg.*, 18, 1908, p. 141.

THE PASSENGER PIGEON

To the Editor of Science: In 1902, 1904 and 1905 I rented a house at Devon, about sixteen miles west of Philadelphia, and on several occasions a single passenger pigeon visited my garden there. Doves came frequently. I was near enough to the passenger pigeon to make mistake impossible. Its color and size would easily distinguish it from the dove, as well as its method of flight and the use of its tail in rising from the ground, which is so much freer than that of the dove, while the shape of its tail would make it impossible to mistake its spread tail for that of a domestic pigeon. I was at Devon again during the summers of 1907 to 1913 inclusive and four or five times saw a single passenger pigeon. The last time was while motoring in 1913. I was running swiftly along a road not far from the woods and a bird got up by the side of the road and after rising from the ground about fifteen feet started off towards the woods. When its flight changed from semi-perpendicular to horizontal I was not twenty yards from it and could clearly see its breast and the under side of its tail and just afterwards the upper side of its tail still spread as the bird changed its course. I could see where it got up on the road and had an excellent idea of my distance, so that I could judge of its size, as well as its color and the shape of the tail.

I have always felt very skeptical about the "scientific" killing off of the last bird of a species which was so broadly distributed and most of whose haunts were so far from the abode of any one who would be likely to write for the papers. It may be what professional scientists would call scientific, but to me, as a business man, it has seemed pretty much like jumping at conclusions and trading on one's ignorance.

F. R. Welsh

QUOTATIONS

THE BRITISH BIRTH RATE

It is very difficult to bring home to people the meaning of a tendency so long as that tendency can only be expressed in figures. Yet

few, we think, can read the latest returns of the Registrar-General without realizing that, so far as population is concerned, all is not well with our state. These figures—the quarterly return of marriages, births and deaths—reveal the outstanding fact that last quarter for the first time since the establishment of civil registration the number of deaths exceeded the number of births. The excess was 79,443. The average excess of births over deaths in the fourth quarter of the three preceding years was 44,785.

This lamentable state of matters requires, however, to be viewed in the light of the influenza epidemic. The Registrar-General regards influenza as a primary or contributory cause of death in no fewer than 98,998 instances, or 41 per cent. of the total deaths registered last quarter.

Influenza, however, by no means completely accounts for the fact that the relationship between birth-rate and death-rate is not improving, but is on the contrary getting worse. Even if we deduct all the influenza deaths the situation remains disquieting.

There is one chief remedy—the saving of those children we have. The fact that of 161,775 births in the quarter under consideration 10,367 were illegitimate should not be lost sight of. At present the way of the illegitimate child in a health sense is hard and dangerous. It must, we think, in the national interest be safeguarded. This is an economic and social as well as, perhaps more than, a medical question. But it is not the less on that account urgent.

Medicine can to some extent prevent disease from attacking the child; medicine can not perform miracles. It is a miracle if children brought up in foul and evil surroundings grow up healthy and wholesome men and women. The miracle, incidentally, is usually accomplished not by doctors but by the self-sacrifice and heroism of the mother of the children, who too often loses her own health in the process.

The birth-rate is the lowest on record, even though 8,104 more births occurred than in the fourth quarter of 1917. Marriages increased in the third quarter of 1918 23,710 over the preceding quarter, and 18,672 over the third quarter of 1917.

According to the returns, 662,773 births and 611,991 deaths were registered in England and Wales in 1918. The natural increase of population, by excess of births over deaths, was, therefore, 50,782, the average annual increase in the preceding five years having been 287,664. The number of persons married during the year was 573,614.

The marriage-rate in England and Wales during 1918 was 15.3 per 1,000, the birth-rate 17.7 per 1,000—the lowest on record—and the death-rate 17.6 per 1,000. Infant mortality was 97 per 1,000 registered births.

The number of deaths registered in the last quarter, 241,218 was 127,000 more than in the preceding quarter, and 128,477 more than in the fourth quarter of 1917. The civilian deaths correspond to a rate of 26.8 per 1,000 of the civil population in 1917. The highest death-rate recorded in England and Wales as a whole in any previous quarter was 25.5 per 1,000 in 1846.—The London *Times*.

SCIENTIFIC BOOKS

The Pygidiidæ, a Family of South American Catfishes. By C. H. EIGENMANN. Mem. Carnegie Mus. 7 (5), 259–398; pls. 36–56.

The catfishes described in this excellent monograph are generally burrowers. They are usually characterized by the presence of spines on the opercula and interopercula and the absence of an adipose fin. The opercular spines render the fishes difficult to dislodge from cavities into which they are accustomed to insinuate themselves. Certain specialized types commonly live as parasites in the gill chambers of other fishes and some are even said to enter the urethræ of mammals, including man. *Nematogenys* from central Chile is the most primitive living representative, and resembles the Siluridæ in certain characters. The eighteen other genera are distributed throughout South America. Most pygidiids are slender, slimy fishes "as slippery as the proverbial eel." Eighty-nine species are described; sixty-three being placed in the genus *Pygidium,* which is said to occur "probably in

all mountain streams north of the latitude of Buenos Aires and sporadically in the lowlands."

Though the monograph is intended primarily to give a systematic survey of the fishes included, the writer's interesting style makes many parts very entertaining for the general reader.

A. S. Pearse

THE PARIS ACADEMY OF SCIENCES

The recently issued *Annual of the Académie des Sciences* for 1919[1] records the election of fourteen new members in 1917 and 1918, seven in the former, and the same number in the latter year; none had been chosen from January 19, 1914, to February 26, 1917, an interval of over three years. Of these new members three belong to the section *Géographie et Navigation,* Ernest Fournier, Robert Bourgeois and Louis Fave; two enter the section *Botanique,* Henri Lecomte and P. A. Dangeard; one is credited to the section *Minéralogie,* Émile Haug; one to the section *Médecine et Chirurgie,* Edouard Quénu; one to *Économie Rurale,* Emmanuel Leclainche, and one to the section *Mécanique,* Gabriel Koenigs. In addition there are three chosen for the new division *Applications de la Science à l'Industrie,* namely, Maurice Leblanc, Auguste Rateau and Charles Charpy, and also one new non-resident member, Charles Flahault, of Montpellier. Last, but not least, Marshall Ferdinand Foch was elected *Académicien Libre,* on November 11, 1918, the day on which took place the signing of the armistice between the Allies and the Central Powers, one of the great events of history, and one to which the masterly military leadership of Foch had chiefly contributed.

It is worthy of note that an institution so thoroughly imbued with the most ardent patriotism still retains on its rolls the name of one German as *Associé Étranger,* namely Simon Schwendener of Berlin. There are also nine German *Correspondents* and two Austrians, one of these the great mineralogist, Gustav Tschermak. This shows that whatever may have been the animus displayed by individual scientists in both camps, this great institution, though placed in the vortex of the fearful conflict, did not lose the conviction that science is international and eternal.

In the *Annual* is given an imposing list of the prizes adjudged annually, or at longer intervals, as well as of the special foundations or funds, and also of the medals regularly awarded. Here we have details regarding 94 different prizes, 10 foundations or funds, and 3 medals, the "Arago Medal," last awarded in 1887, the "Lavoisier Medal" of which the last award was in 1900 and the "Berthelot Medal" that has not been adjudged since 1902.

The president of the Académie des Sciences for the present year is M. Louis Guignard, the vice-president being M. Henri Deslandes. As it is an invarable rule that the vice-president succeeds to the presidency in the following year, M. Deslandes will be, if still living, the next president. The perpetual secretaries are M. Alfred Lacroix, elected in 1914, for the department of *Sciences mathématiques,* and M. Émile Picard, elected in 1917, for that of *Sciences physiques.*

K.

[1] "Institut de France, Académie des Sciences, Annuaire pour 1919," Paris, Gauthiers-Villars et Cie, 178 pp, 8vo.

SPECIAL ARTICLES

SOME PHYSICAL IMPROVEMENTS IN NATIONAL ARMY MEN UNDER MILITARY TRAINING[1]

At the present time when the interest of the country is focused on the military policy of the future, it is worth while to record the effects of training on the physique of men who enter the army from civil life. This has been done before in the case of recruits and university men, and data secured from the men who trained for the present conflict constitute interesting material for comparison. It is a matter of common knowledge that civilians usually show an increase in weight and a generally improved condition after a

[1] From the Section of Food and Nutrition, Medical Department, U. S. Army.

period of military training, and the information here given simply reduces this well-known fact to a quantitative basis. Some of the measurements from which this material was derived were made by officers of the Division of Food and Nutrition of the Medical Department, U. S. A., in the course of investigations of the army mess in camps in the United States; the remainder were secured from records of physical examinations at the time the men entered the service. The conditions under which all the measurements were taken were such that no great accuracy can be claimed for them; however, as they were made on a considerable number of men, at various times, and by different persons, such errors as exist will in all probability be compensating.

The first study to which attention will be called was made on the weights of the men of three companies at Camps Dodge, Funston and Grant, respectively, approximately four months after the men had enlisted. At this time, the weights of the soldiers in these companies were secured by Captain Leon A. Congdon, one of the field officers of the division. The original weights of the men, as noted above, were obtained from records of physical examination made at enlistment. The results of Captain Congdon's work are shown in Fig. 1 in the form of distribution graphs. The weights were divided for plotting into groups differing by five pounds, and the number of individuals in each group was noted. Abscissas on the graph represent successive groups increasing in weight toward the right

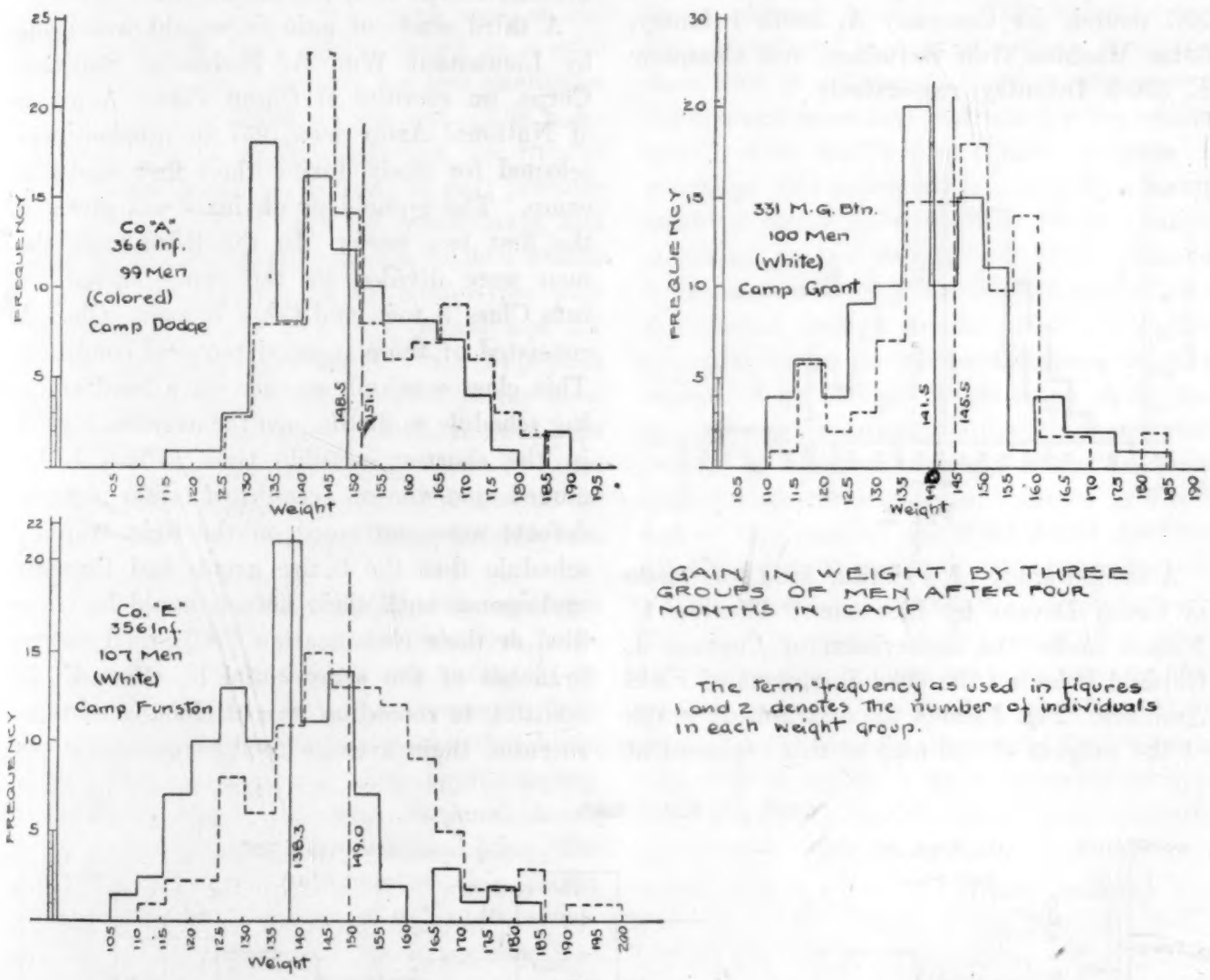

FIG. 1.

and ordinates show the number of men in each group. The number of men in the various weight groups at the time of enlistment is shown for each of the organizations as a solid line while the distribution of weights of the same men after four months is shown as a dotted line. Corresponding averages of the two sets of weights for the three organizations are similarly indicated. It will be noted that the average gain was 2.6, 4.0 and 10.7 pounds for Company A, 366th Infantry, 331st Machine Gun Battalion, and Company E, 356th Infantry, respectively.

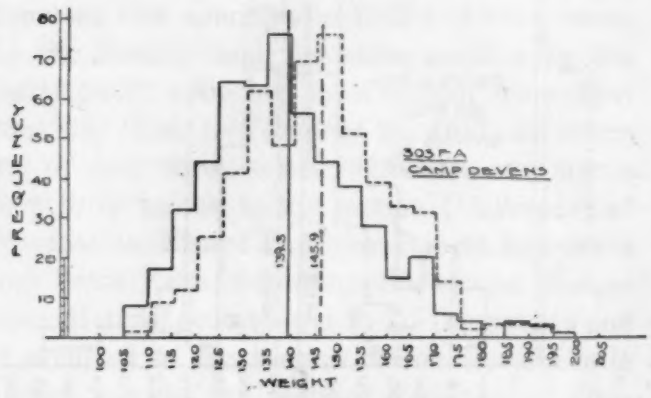

Fig. 2.

A second study of a similar kind was made at Camp Devens by Lieutenant Thurlow C. Nelson under the supervision of Captain J. Garfield Riley on the 303d Regiment of Field Artillery. Fig. 2 shows the distribution graph of the weights of 523 men of this regiment at enlistment and approximately six months later. For the men of this group, chest and height measurements were taken as well as weight. It was found that the height of the group remained approximately stationary, but that chest motility increased on the average 0.7 inches during the five months of training. The increase in motility is considerable, representing as it does a 23 per cent. gain over the average of the men at enlistment.

A third study of gain in weight was made by Lieutenant Wm. A. Perlzweig, Sanitary Corps, on recruits at Camp Pike. A group of National Army men, 257 in number, was selected for study during their first weeks in camp. The typhoid prophylaxis was given in the first two weeks. In the third week the men were divided by the camp authorities into Class A men and Class B men. Class A consisted of those in good physical condition. This class was put at once on a hard training schedule to fit the men for overseas service in the shortest possible time. Class B included men who on account of minor physical defects were continued on the light training schedule that the entire group had formerly undergone, until their defects could be remedied or their classification for limited service branches of the army could be effected. In addition to recording weight changes of these recruits, their average food consumption per

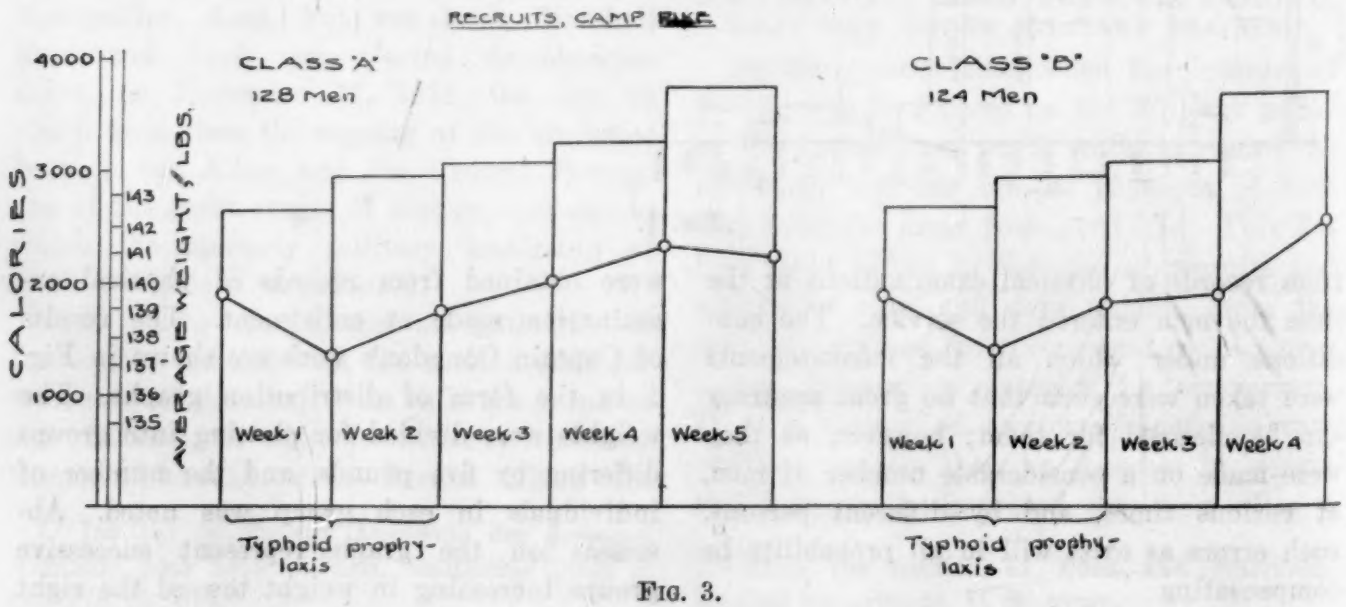

Fig. 3.

week was determined. The investigation covered the first five weeks after enlistment for Class A and the first four weeks after enlistment for Class B, at the end of which periods it was found necessary to discontinue the study. Fig. 3 shows graphically the results obtained. The average energy value per man per day of the food consumed during each week is represented by a series of blocks. The average weight per man was measured at the beginning of each week and at the end of the last week and is shown as a solid line. The scales on which the two quantities are plotted are shown at the left. The noteworthy features of the study are the drop in weight during the first week, in part presumably a result of the typhoid prophylaxis, and subsequent rise for both groups of men resulting in a net increase of 1.4 pounds per man for Class A for a five-week period and 2.6 pounds per man for Class B for a four-week period. The consumption of food in the mess shows a very large increase in both cases. In examining Fig. 3 it should be borne in mind that up to the beginning of the third week the group of recruits had not been divided into Class A and Class B.

It is of interest to compare the averages for these studies with similar averages made in the past. Before doing this it should be stated that all of the groups reported here average approximately 68 inches in height in their stocking feet, and were approximately 25 years of age. All were National Army men, secured by draft from civilian life. The average weight for civilians of this height and age has been determined to be 145 pounds in ordinary clothes.[2] As the army examination uses stripped weight a deduction must be made for the weight of the clothes. Assuming six pounds as the probable value of this, 139 pounds may be taken as the stripped weight of civilians 68 inches tall. According to this standard the men of all the organizations except Company A, 366th Infantry, were about normal in weight at enlistment. In ordinary times recruits for the regular army are drawn chiefly from the laboring classes and show an average weight of approximately 147 pounds for the age and height of the groups here studied.[3] The difference of seven pounds in the average weight of regular army recruits in peace times and these National Army men is probably a result of the changed character of the army due to the draft. It will be noted that Company A of the 377th Infantry consists of colored men; the average weight of these men at enlistment is practically that of the average peace time recruits for the regular army. Also the average rate of gain in weight of this organization is less than in any other of those here studied. With the one exception just noted, all of these National Army men, although they closely approximate the normal civilian weight, made a considerable gain under the rather strenuous training régime of the camp. There is no doubt that this is a gain almost entirely in muscular tissue. A weighted average of the increases made by the three companies shown in Fig. 1 and of the men of the 303d Field Artillery gives 6.4 pounds as the mean increase in body weight for the men of the four organizations. The average weight of these men *after training* (146.8 pounds) is about the same as that of the average peace time *recruit* (145.1). According to Munson the peace time recruit, who is undoubtedly a much more robust type physically than the National Army recruits, gains about 2.8 pounds as a result of three and a half months of military training and the gain of 6.4 pounds of the National Army men is thus not at all surprising. The twenty-three per cent. increase in chest motility shown by the men of the 303d Field Artillery is scarcely second to their weight increase as an index of improvement in physical condition. The men of this regiment showed an average motility at enlistment of three inches. This is a little higher than that shown by the

[2] "Medico-actuarial Mortality Investigation," Vol. I. Association of Life Insurance Medical Directors and Actuarial Society of America, New York, 1912.

[3] "The Theory and Practise of Military Hygiene," E. L. Munson, New York, William Wood & Co., 1901.

TABLE I

Group	Length of Training Period	Original Weight Lbs.	Weight After Training, Lbs.	Gain, Lbs.	Motility at Enlistment, Inches	Motility After Training, Inches	Gain, Inches
Peace time recruits to Regular Army at Columbus Barracks	3½ mos.	145.07	147.88	2.81	2.804	3.410	0.606
Civilians (men 68″ tall and 25 years old)	——	139					
523 men of 303 F. A.	6 mos.	139.3	145.9	6.6	3.00	3.70	0.700
99 men (colored) Co. A, 366 Inf., Camp Dodge	4 mos.	148.5	151.1	2.6			
100 white men, 331 Mch. Gun Bn., Camp Grant.	4 mos.	141.5	145.5	4.0			
107 men (white) Co. E, 356 Inf., Camp Funston.	4 mos.	138.3	149.0	10.7			
Class "A" Recruits, 134 men, Camp Pike	5 wks.	139.54	140.94	1.40			
Class "B" Recruits, 123 men, Camp Pike	4 wks.	139.50	142.07	2.57			

group of regular army recruits mentioned by Munson, whose motility at enlistment averaged 2.8 inches. The regular army recruits increased 0.6 inches in motility as a result of three and a half months' training, while the 523 men of the 303d Field Artillery showed an average increase of 0.7 inch in five months.

The recruit study at Camp Pike indicates the relation between gain in weight and food consumption. It is of course obvious that without proper feeding physical improvement of the men is greatly retarded no matter how favorable other conditions are. It is possible, however, with conditions as they exist in the army, to feed men very satisfactorily from a nutritional point of view and at the same time very economically. A consideration of the remarkable physical gain outlined above of men in the 303d Field Artillery, taken in conjunction with the regimental waste record, shows this very conclusively. During the week of the survey made in order to determine the food consumption of the men of the regiment there was no waste of edible food. This means that every man left the table with an empty mess kit, and that all left-overs from the kitchen were utilized in subsequent meals. While such a remarkable record is exceptional, mess economy in this regiment was at all times of a high order. The beneficial effects of the discipline necessary to secure such results will probably never be lost by the men who were in the organization. The average energy value of the food consumed per man per day in the 303d Field Artillery was 3,699 calories, a figure typical of the consumption found in army messes generally.

RECRUITS, CAMP PIKE

Class	Weight, Average					
	July 1	July 7	July 13	July 20	July 28	Aug. 4
A (134 men)	139.54	137.69	138.93	140.02	141.46	140.94
B (123 men)	139.50	137.78	139.20	139.55	142.07	——
	Food Consumption, Calories per Man per Day					
	July 1–7	July 7–13	July 13–20	July 20–28	July 28–Aug. 4	
Class A	2,640	2,931	3,085	3,227	3,715	
Class B	2,640	2,931	3,085	3,675	——	

The material discussed in the above paragraphs is summarized in Table I. It should be said in closing this article that the *typical* army mess furnishes a sufficient amount of nutritious well-cooked food to meet the requirements of the average soldiers. This is supported by such evidence as has been adduced above and obviously also by the fine army turned out in the training camps of this country for service overseas.

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